MODULAR WALL PANEL WITH HEATED VENTILATOR

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority on U.S. Provisional Patent Application Serial No. 60/319,298, filed on June 6, 2002.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to modular wall panels for open office arrangements, and, more particularly, to ventilation systems through such panels.

Description of the Related Art

Modular wall panels for open office arrangements are well known in the art. Typically individual wall panels are interconnected in different configurations to form separate workstations. These panels are extremely durable, and can be readily assembled into alternative configurations to meet the specific needs of a user.

One of the problems with such portable wall panel systems and other forms of modular furniture systems is the potential result of poor or uneven distribution of ventilation air at the workstations due to the impeding of airflow by the furniture units themselves. Some workstation ventilation systems have been developed, but the known systems require large capital expenditure, lack aesthetics, lack functionality, or require a difficult or disruptive installation.

Even where ventilated air is directed through wall panel systems, the ease of rearrangement is compromised because they are horizontally oriented. There is a need for a simple, effective ventilation system that can be integrated into a modular wall panel without compromising its adaptability.

SUMMARY OF THE INVENTION

The invention solves these and other problems by providing a wall panel comprising a first opening and a second opening. The first opening is above the second opening, and a channel for directing air extends between the first and second openings. A fan is within the channel and, when activated, moves air from the first opening toward the second opening. A heat exchanger is disposed within the channel

so that when the fan and heat exchanger are actuated, air will be drawn into the channel from the first opening, heated or cooled within the channel, and exhausted from the second opening at a different temperature from air entering the first opening.

Preferably, the heat exchanger is located downstream from the fan. The second opening can be located at a lower end of the panel. For example, it can be located just above the rail along the bottom edge of one of the flat surfaces of the panel. Similarly, the first opening can be at an upper end of the panel. Preferably, it will be located on the top edge of the panel.

The channel is preferably a duct and made of metal. The fan is preferably an impeller fan and the heat exchanger is the type that heats the air. In this aspect, it can be a resistance heater.

Typically, the fan and the heat exchanger are removable from the channel. An insulation block is normally disposed between the fan and the heat exchanger and is also removable from the channel. A heat/air deflector helps to control the flow of air within the panel. The heat/air deflector preferably comprises two downwardly angled deflection wings and is removable from the channel. The wall panel itself can be modular.

In another aspect of the invention, a modular wall panel comprising a first opening at an upper end and a second opening at a lower end with a channel therein for directing air between the first and second openings has a modular housing adapted to be removably mounted to the wall panel within the channel. The modular housing has a fan and a heat exchanger so that when the modular housing is mounted, the fan and heat exchanger will be disposed to move air from the first opening to the second opening and heat it or cool it before it is exhausted from the second opening.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a perspective view of a wall panel according to the invention;

FIG. 2 is a cross sectional view of the wall panel of FIG. 1;

FIG. 3 is a cross sectional view of an alternative embodiment of the wall panel of FIG. 1;

FIG. 4 is a cross sectional view of the modular housing of FIG. 3;

FIG. 5 is a perspective view of a third embodiment of the wall panel of FIG. 1;

FIG. 6 is a perspective view of the wall panel of FIG. 5 with a front flat surface removed and with an exploded view of a cap and a register cover assembly;

FIG. 7 is a perspective view of the register cover assembly from the wall panel of FIG. 5;

FIG. 8 is a perspective view of a fan unit from the wall panel of FIG. 5;

FIG. 9 is a perspective view of an air/heat deflector from the wall panel of FIG. 5;

FIG. 10 is a perspective view of a fan unit/deflector assembly comprising the components in FIG. 8 and 9; and

FIG. 11 is a perspective view of a heat exchanger from the wall panel of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A wall panel 10, preferably modular, according to the invention is shown and FIG. 1 having a general appearance common to a typical modular wall panel. The panel 10, with an upper end 13 and a lower end 15, has a pair of parallel flat surfaces 12, 14 bounded by side edges 16, 18, and a top edge 20. A rail 22 along a bottom edge 17 of one of the flat surfaces 12 typically covers a raceway for power and other elements common to the art. Power sockets 24, 26 are typically disposed in the rail 22.

Looking now also at FIG. 2, it can be seen that the wall panel 10 is hollow. A channel 28 runs vertically in the panel 10 between the top edge 20 and the rail 22. One end of the channel 28 opens through the top edge 20 at a first, upper opening 30, and the other end of the channel opens through the flat surface 12 at a second, lower opening 32 just above the rail 22. It will be understood that it is important only that one opening be above another; the exact location of the openings is not critical. For example, the upper opening 30 can be located at the upper end 13 of the flat surface 12. Also, the lower opening 32 can be at the lower end 15, through the rail 22, or anywhere on the flat surface 12 below the upper opening 30. Also, the upper and

lower openings 30, 32 need not be on the same side of the flat surface 12. The idea is to enable delivery of air from an upper portion of the workspace to a lower portion of the workspace. Preferably, the openings 30, 32 are covered with diffusers or grills.

Within the channel 28, preferably at a lower end thereof, is a fan 34 disposed to move air from the upper opening 30 toward the lower opening 32. It will be understood that the fan can be located anywhere in the channel 28, or even at the ends of the channel. It is important the fan be located so as to move air through the channel. Also any type of fan is acceptable, although some may preferable over others. For example, a squirrel cage fan may be preferred in some applications and an impeller fan may be preferred in others. Also, more than one fan may be required to move the volume of air needed for a given application. The fan 34 is electrically connected to a power source (not shown) that might include a power conduit in the raceway . The fan 34 will also be connected to a power switch 36 mounted on the panel 10 or elsewhere. The power switch can be a wired or wireless remote. The power switch 36 can also be a thermostat and/or a remote control sensor.

Preferably downstream from the fan 34 within the channel 28 is a heat exchanger 38. The heat exchanger can be a heating element that will typically be one or more resistance wires connected to the power source and/or the thermostat 36. The type of heating element is not critical to the invention. The heat exchanger can also be a cooling unit to reduce the air temperature exiting the lower opening 32.

It will be understood that the fan can be operated independently of the heat exchanger, although safety regulations would likely prevent operation of a heating element when the fan is not also operated. Nevertheless, it may be desirable to operate the fan when the heat exchanger is not actuated.

In operation, it will be seen that actuation of the fan 34 will draw air from the upper opening 30 through the channel 28, past the heat exchanger 38 and toward the lower opening 32. In this way, when the panel 10 is installed in a workstation arrangement, room air is utilized to modify the air temperature in the workspace.

An alternative embodiment is illustrated in FIG. 3 and 4 where it can be seen that like elements carry like reference numerals. The principal difference is that the heat exchanger 38 and fan 34 are installed in a separate modular unit 40 that can be

easily inserted into the lower opening 32 of the channel 28. The modular unit 40 comprises a housing 42 having an inlet end 44 and an outlet end 46. The cross section of the inlet end 44 is orthogonal to the cross section of the outlet end 46, and the longer wall 48 of the housing 42 is arcuate. The fan 34 and heat exchanger 38 are disposed within the housing 42 near the inlet end 44.

The housing 42 is adapted to be removably secured within the channel 28 such as by tabs, detents and the like. Preferably, the fan 34 and heat exchanger 38 have a single electrical connector that is adapted to mate with another electrical connector connected to the power source. Installation of the housing 42 within the channel 28 is easily accomplished by inserting the inlet end 44 into the lower opening 32 and rotating the housing until the outlet end 46 is parallel to the flat surface 12, while the housing is simultaneously secured therein by the tabs, detents or the like.

A third embodiment is illustrated in FIGS. 5 and 6 where it can be seen that like elements carry like reference numerals. In this embodiment, the channel 28 with the upper and lower openings 30, 32 is defined by a duct 50 composed of any suitable material, but preferably constructed with a metallic material. The duct 50 has parallel front and rear walls 52, 54, respectively, and parallel side walls 56, 58. The rear wall 54 and side walls 56, 58 extend at least from the upper opening 30 to at least the bottom of the lower opening 32, and the side walls 56, 58 have angled slots 59, best seen in FIG. 11, adjacent the lower opening 32. The front wall 52 extends from at least the upper opening 30 to the top of the lower opening 32.

As shown in FIG. 6, a cap 60 covers the upper opening 30 and extends to the side edges 16, 18 of the wall panel 10. The cap 60 has grated slots 62 positioned over the upper opening 30 to permit transfer of air yet prevent undesired debris from entering the channel 28. Any suitable size, orientation, or number of grated slots may be employed to accomplish this function.

Similarly, a register cover assembly 64, shown in FIG. 6 and in detail in FIG. 7, comprising a rectangular cover 66 with grated slots 68 is positioned in and covers the lower opening 32. The cover may be of any suitable shape and contain any reasonable size, number, or configuration of grated slots. Further, the register cover assembly 64 has an attachment clip 70 for securing the register cover assembly 64 in

lower opening 32 and an arcuate extension 72 that projects into the channel 28 to direct air towards the lower opening 32 when in use.

The third embodiment further includes a fan unit 74, shown in FIG. 8, and an air/heat deflector 76, shown in FIG. 9. The fan unit 74 comprises a fan, preferably an impeller fan 35, a base 78, clips 80, 82, and an insulation block 84. The impeller fan 35 is mounted to the base 78 such that the exhaust port of the fan 35 abuts the flat surface of the base 78, and the insulation block 84 is located on the side of the base 78 opposite the fan 35. The clips 80, 82, which comprise metal strips with a portion thereof folded upon themselves at one end, are mounted on the same side of the base 78 as the fan 35 and extend orthogonally downward. While the clips described herein are preferred, any type of fastener suitable for mounting the base 78 within the channel 28 may be utilized. An aperture 85 and a slit 86 are provided in the base 78 and the insulation block 84 for air flow from the fan 35 and for electrical wiring, respectively.

The air/heat deflector 76 has a center body 88, a crimp 90, triangular flaps 92, and deflection wings 94. The crimp 90 is an orthogonal extension of the center body 88 and is provided for attachment of the deflector 76 to the fan unit 74 to form a fan unit/deflector assembly 98, as shown in FIG. 10. The fan unit/deflector assembly 98 is arranged such that the center body 88 of the deflector 76 is positioned beneath the aperture 85 and is coplanar with the lower flat surface of the insulation block 84. The triangular flaps 92 of the deflector 76 extend downward at an angle from the center body 88 such that air from the aperture 85 flows downstream past the center body 88 and is forced downward by the deflection wings 94 which extend diagonally from the center body 88 to the side walls 56, 58 of the duct 50 when located in the duct 50, as in FIGS. 5 and 6.

The heat exchanger 38 of the current embodiment in FIG. 11 is a conventional single rod heat exchanger with electrical leads 96 on each end. The heat exchanger 38 preferably acts to heat the air, and is, preferably, a resistance heater 41.

Assembly of the above components commences by attaching the air/heat deflector 76 to the fan unit 74 via the crimp 90 to form the fan unit/deflector assembly 98. Next, the fan unit/deflector assembly 98 is introduced into the channel 28 through

the lower opening 32 with the fan portion of the assembly 98 ahead of the deflector portion, raised to a position wherein the insulation block 84 is located above the lower opening 32 but end of the clips 80, 82 are positioned below the top of the lower opening, and secured to the front wall 52 of the duct 50 by moving the assembly 98 upward such that the clips 80, 82 engage the front wall 52 of the duct 50. Once the fan unit/deflector assembly 98 is in place, the ends of the heat exchanger 38 are inserted into the angled slots 59 of the side walls 56, 58 of the duct 50. Finally, the register cover assembly 64 is inserted into the lower opening 32 and secured by the attachment clip 70.

In operation, actuation of the fan 35 draws air from the opening 30 through the channel 28, into the side of the fan 35, out the bottom of the fan 35, through the aperture 85 in the base 78 and the insulation block 84, past the center body 88 and tabs 92 of the air/heat deflector 76, along the deflection wings 94 of the air/heat deflector 76, past the heat exchanger 38, and toward the lower opening 32.

While the invention has been specifically described in connection with certain specific embodiments thereof, it is to be understood that this is by way of illustration and not of limitation, and the scope of the appended claims should be construed as broadly as the prior art will permit.